REMARKS

By this amendment, claims 1 and 5 have been amended. Accordingly, claims 1-27 are pending in the present application. Support for the claim amendments can be found in the application and claims as filed. Accordingly, favorable reconsideration of the pending claims is respectfully requested.

1. Rejections Under the Judicially Created Doctrine of Double Patenting

Claims 1-27 have been rejected under the judicially created doctrine of obviousness-type double patenting over claims 1-46 of U.S. Patent No. 6,150,257 to Yin et al. for the reasons set forth on page 2 of the Office Action.

This rejection will be addressed when allowable subject mater has been indicated by the Examiner.

2. Rejections Under 35 U.S.C. §103

Claims 1, 2, and 5-27 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,529,954 to Iijima et al. (hereinafter "*Iijima*") taken with U.S. Patent No. 5,633,200 to Hu (hereinafter "*Hu*") for the reasons set forth on pages 4-5 of the Office Action. Applicants respectfully traverse.

As stated in the application as filed:

> The present invention relates to the formation of an ILD layer while preventing or reducing oxidation of the upper surface of an interconnect or contact stud. Prevention or reduction of oxidation of the upper surface of an interconnect is achieved according to the present invention by **passivating** the exposed upper surface of the interconnect prior to formation of the ILD.

Page 9, lines 6-10 (emphasis added). To this end, present claims 1 and 6 of the present application recite: (1) "reacting a chemical composition with at least one monolayer of said upper surface to form a passivation layer;" and (2) "said second dielectric layer is adhered to said electrically conductive film." Thus, although a passivation layer is formed upon the upper surface of the electrically conductive film, it does not create a layer that permanently separates the electrically conductive film from the second dielectric layer.

In contrast, in *Iijima* it is the TiO_2 film 36 that is next to the second dielectric layer, making it an impossibility for the second dielectric layer to adhere to the electrically conductive film. Similarly, in *Hu* the WNi film separates adjacent layers. These are not the methods of the present invention as claimed.

Each of the remaining independent claims (10, 15-18, and 23-25) recite a variation of the above claim language that are also not taught or suggested by the cited references for the same reasons.

In response to an earlier version of the above arguments, the Examiner has indicated that: "Applicant nonetheless has failed to show that the adhesion of the dielectric to the conductive layer would not take place in Iijima et al. and that the chemical reactions would not take place due to the proximity between the dielectric layer and the nitriding layer. It remains that such layers would be apparent due to the proximity thereof." Office Action, page 6. Nevertheless, Applicants respectfully remind the Examiner that in order to make a *prima facie* case of obviousness the prior art must teach or suggest all the claim limitations. Further, "[t]he Examiner bears the initial burden of factually supporting any *prima facie* conclusion of

obviousness." MPEP §2143.03. Therefore, the Examiner is respectfully requested to provide factual support for the foregoing rejection or remove the rejection.

The differences between the cited references and the present invention are further exemplified by the thicknesses disclosed by the cited references. *Iijima* performs an anneal to form discrete TiO_2, TiN, and MgN_x layers that are sufficiently thick to be used as an etch stop (Col. 6, lines 40-41) and prevent silver agglomeration (Col. 6, lines 26-31). In fact, the minimum thickness of these layers is 150 Å (Col. 11, lines 14-16), which is several times the maximum thickness disclosed in the application.

Hu discloses physical vapor deposition processes to form large grain tungsten nitride films for use as a diffusion barrier. Col. 8, lines 19-23. The only disclosed thickness for the tungsten nitride film is 100 nm (1,000 Å). Col. 9, lines 47-50.

The differences between these cited ranges and those disclosed in the present application emphasize the fact that whereas the cited references disclose forming a layer that separates an interconnect from an opposing structure, the presently recited claims recite a method that merely passivates the interconnect so that formation of the overlying structure does not oxidize the interconnect.

Therefore, although Applicants do not view thickness recitations as necessary to claim the invention, such reasons do provide additional reasons for patentability. Each of claims 6, 7, 12, 15, 20, and 23 thus recites some form of the limitation that the passivation layer has "a thickness not greater than about 50 Å upon the upper surface" or "a thickness in a range from about 2 Å to about 20 Å." Because neither *Iijima* nor *Hu* is concerned with forming a passivation layer as described hereinabove, let alone one having a thickness less than about 50 Å or from about 2 Å to about 20 Å, *Iijima* and *Hu* fail to teach or suggest the limitations of

claims 6, 7, 12, 15, 20, and 23.

The Examiner has indicated that "the selection of such non-critical thickness would have been one that is normally within the purview of one skilled in the art and would have been a matter of routine experimentation and optimization." Office Action, page 7. In response, Applicants respectfully assert that the Examiner is failing to give appropriate consideration to the invention as disclosed and presently claimed. As stated succinctly in the application: "[t]he present invention relates to the formation of an ILD layer while preventing or reducing oxidation of the upper surface of an electrically conductive interconnect or contact. Prevention or reduction of oxidation of the upper surface of an interconnect or contact is achieved according to the present invention by passivating the exposed upper surface of the interconnect or contact prior to formation of the ILD." Specification at page 9, lines 6-10. Thus, the presently recited claims recite embodiments of the invention that provide a method for *passivating* an upper surface of a conductive film while preventing oxidation of the conductive film, not to the formation of a barrier layer that would prevent an overlying dielectric layer from adhering to the underlying conductive film. In various embodiments of the invention, it is the relative thinness of the passivating layer (*i.e.* "a thickness not greater than about 50 Å) that enables this feature of the invention.

Therefore, because the cited references disclose the formation of diffusion barriers and etch stops, not passivating layers as presently disclosed and claimed, there is no motivation for "routine experimentation and optimization" to select the recited thicknesses, which are substantially smaller than taught by the cited references.

Additionally, claim 5 has been amended to recite a feature of the present invention that, in combination with the other recited features, is not taught or suggested by the cited

references: "the passivating layer chemically protects the first one to one thousand atomic lattice layers of the upper surface."

Regarding claim 13, 16, 21, and 24, *Iijima* and *Hu* do not teach or suggest multiple passivation layers, let alone a first passivation layer comprising a tungsten nitride film and a second passivation layer comprising ammonia and its derivatives that is adsorbed onto the first passivation layer. Regarding claims 14, 17, and 22, 25 *Iijima* and *Hu* do not teach or suggest that the passivation layer is adsorbed onto the electrically conductive film.

Therefore, the combination of *Iijima* with *Hu* fail to teach or suggest the limitations of claims 1, 2, and 5-25, and the withdrawal of this rejection is respectfully requested.

Claims 3 and 4 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over *Iijima* taken with *Hu* and further in view of U.S. Patent No. 5,592,024 to Aoyama et al. (hereinafter "*Aoyama*") for the reasons set forth on page 5 of the Office Action. Applicants respectfully traverse.

Claims 3 and 4 depend from claim 1 and thus include the limitations thereof, including the specific limitations of "reacting a chemical composition with at least one monolayer of said upper surface to form a passivating layer over the upper surface" and "said second dielectric layer is adhered to said electrically conductive film." In addition to being absent from *Iijima* and *Hu*, such limitations are also not taught or suggested in *Aoyama*. Thus, even if the cited references are combined as suggested by the Examiner, not all of the claim limitations are met.

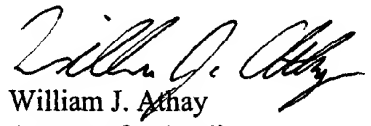
Accordingly, Applicants therefore respectfully request that the rejection of claims 1-25 under 35 U.S.C. § 103(a) be withdrawn.

CONCLUSION

In view of the foregoing, Applicants respectfully request favorable reconsideration and allowance of the present claims. In the event the Examiner finds any remaining impediment to the prompt allowance of this application that could be clarified by a telephone interview, the Examiner is respectfully requested to contact the undersigned attorney.

Dated this 26th day of September 2002.

Respectfully submitted,



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VERSION WITH MARKINGS SHOWING THE CHANGES MADE

In the claims:

Please amend claims 1 and 5 as follows:

1. (Once Amended) A method of forming an electrical device including providing a substrate having a first dielectric upper layer, forming a depression in said first dielectric upper layer, filling said depression with an electrically conductive film having an electrical resistivity and an upper surface that is co-planar with the first dielectric upper layer, said method comprising:

reacting a chemical composition with at least one monolayer of said upper surface to form a passivating layer over the upper surface; and

forming a second dielectric upper layer over said electrically conductive film and said first dielectric upper layer, wherein:

at least an exposed surface of the electrically conductive film is unoxidized; and

said second dielectric upper layer is adhered to said electrically conductive film.

5. (Twice Amended) The method as defined in Claim 1, wherein [reacting said chemical composition with at least one monolayer of said upper surface forms a passivation layer upon said upper surface of said electrically conductive film] the passivating layer chemically protects the first one to one thousand atomic lattice layers of the upper surface.